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Remote Sensing Techniques to Measure Dew: The Detection of Canopy Water with an L-Band Passive Microwave Radiometer and a Spectral Reflectance Sensor

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ABSTRACT

A technique to quantify the amount of dew on grassland with an L-band (1.4 GHz) passive microwave radiometer has been presented. The horizontal polarized brightness temperature is sensitive to dew and morning dew can increase the temperature up to 5 K. This is in contrary to recent published results, where they expect that dew does not have any effect on L band (1.4 GHz) observations. By using both the horizontal and vertical polarized brightness temperature in combination with measured soil moisture conditions we were able to estimate the amount of dew. The results compared well with another remote sensing technique to measure dew using a spectral reflectance sensor. In addition, a simple comparison study was done to study the sensitivity of the microwave emission on dew events and changes in internal water. This study showed that the microwave emission at L band is more sensitive to changes in dew than to changes in internal vegetation water content when the soil is wet. When the soil is dry, the microwave emission is more sensitive to internal vegetation water.

Keywords: dew, passive microwave remote sensing, spectral reflectance, vegetation water content

1. INTRODUCTION

The occurrence of dew can be important in many environmental studies. Dew recharges the soil moisture and limits evaporation from the soil during the time the dew is forming. In deserts dew can serve as a source of water for small animals, and plants[1]. A study with Mediterranean shrubs and plants showed that plant leaves can absorb dew and thus restore plant water status[2]. Dew can also favor any plant pathogen, whose spores or cells require free water to germinate[3].

On a different note, dew can also have a significant effect on remote sensing sensors who observe the earth when dew is forming. In 1986 Pinter[4] showed the effect of dew on spectral reflectances in the visible and mid infrared region, which can have serious implications for the satellite observations in these wavelength regions, like the morning scans of the Landsat satellites.

Passive microwave sensors are also sensitive to vegetation water and several current satellites such as the Special Microwave Imager (SSM/I) but also future sensors like the ESA's Soil Moisture Ocean Salinity (SMOS) mission and NASA's HYDROS will collect data when dew is likely.

According to several authors[5,6] dew should not have any effect on L band (1.4 GHz) observations and in extreme levels it may effect C band (5 GHz). The current research will show that this is not true. The objectives of the present study were to evaluate the effects of dew on the L-band observations, to quantify the dew density, and to compare it to the effects of internal vegetation water on L-band observations.

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